Prediction Markets


Outline

• Introduction to prediction markets
• Empirical Paper
• Paper on Google and Information Flows
• Current prediction markets
Let’s go back in time ...

... to June 2012
What is the probability that Mitt Romney wins the election?
What is the probability that Mitt Romney wins the election?

• Polls
  – Electoral college
  – Changes before election day
  – Bias

• Pundits
  – “Cheap Talk” Problem

• Forecasting
  – Individual context
Mitt Romney says he is a numbers guy, but in the end he got the numbers wrong. His campaign was adamant that public polls in the swing states were mistaken. They claimed the pollsters were overestimating the number of Democrats who would turn out on Election Day. Romney’s campaign was certain that minorities would not show up for Obama in 2012 the way they did in 2008. “It just defied logic,” said a top aide of the idea that Obama could match, let alone exceed, his performance with minorities from the last election. When anyone raised the idea that public polls were showing a close race, the campaign’s pollster said the poll modeling was flawed and everyone moved on. Internally, the campaign’s own polling—tweaked to represent their view of the electorate, with fewer Democrats—showed a steady uptick for Romney since the first debate. Even on the morning of the election, Romney’s senior advisers weren’t close to hedging. They said he was going to win “decisively.” It
What is the probability that Mitt Romney wins the election?

• New solution: Prediction Markets
  – A financial “futures” market where money is exchanged based on the outcome

• Compare to other forms of “crowdsourced” knowledge
Examples

• Iowa Electronic Markets
• InTrade
  • http://markets.nitle.org
  • http://www.hsx.com
  • http://inklingmarkets.com
  • ...

Winner Takes All (WTA) Market

• Contract has payoff of $0 or $1 based on outcome
• Assumption: event has a clear outcome

Payoff=$1
Romney Wins
Probability = p

Payoff=$0
Romney Loses
Probability=1-p
Winner Takes All (WTA) Market

- $X$ is the payoff
- $P$ is the probability of the outcome occurring
- Let the market price of a share equal $c$

$$E(X) = \begin{cases} p & X = 1 \\ 1-p & X = 0 \end{cases}$$
Winner Takes All (WTA) Market

• Expected Profit for buyer:
  – Profit = Payoff – Cost
  – E(Profit) = E(X)-c
  – E(Profit) = p-c

• Multiple, exhaustive markets summing to 1 (no arbitrage)

• Assuming no risk aversion, expected returns should be equivalent in each of these markets

• P=c

• The market price is the perceived probability of the event occurring
Vote Share Market

• Contract pays $1*X, where X is the vote share of a candidate
• For example, the Bush contract in 2004 would have paid $50.70 (Bush won 50.7% of the vote)
• Bidders auction on contract
• By similar logic as before, C=E(X)
• The market price is the expected vote share
Other Market Types

• Can be used to determine entire probability distributions
  – For example, a contract can pay off the square of the vote share
  – Market price= $E(X^2)$
  – Solve for variance
Other Market Types

• Can be used to determine joint distributions
  – For example, a series of contracts can trade based on the probability of two events occurring
  – Market 1: Probability of Troop Withdrawal by 2010
  – Market 2: Probability of Obama Winning
  – Market 3: Probability of Troop Withdrawal by 2010 AND Obama Wins
  – Solve for $P(\text{Troop Withdrawal} | \text{Obama Victory})$
Paper 1

Introduction

• Are prediction markets accurate?
• When do prediction markets work?
Methodology

• Ran study on IEM
• Continuous double auction market open 24 hours per day
• Vote share or seat share market
• Traders are overwhelmingly, “male, well-educated, high income, and young”
Are Prediction Markets Accurate?
Are Prediction Markets Accurate?

• Benchmark: Polls
• Short-term, prediction markets are at least as good as polls
  – Compared price at midnight on night before election with last day polls
  – Average prediction market error=1.49%
  – Average poll error=1.93%
Are Prediction Markets Accurate?
Are Prediction Markets Accurate?

• Long-term, prediction markets are superior to polls
  – No empirical methodology given for this assertion
  – Example from 1996 as worst performing short-term prediction, yet relatively stable long-term prediction
Are Prediction Markets Accurate?
When do prediction markets work?

• Necessary criteria
  – “Enough traders so that the aggregate of their knowledge can forecast correctly the outcome of the election.”
  – Effective market mechanism for revealing collective information

• Markets perform better when:
  – More active participants
  – Fewer contracts
When do prediction markets work?

• Individual Bias
  – Most traders in a market are heavily biased
    • Often vote for what they WANT, versus what is LIKELY
  – Marginal traders empirically tend to be much less biased
  – Marginal traders set prices, not average traders

• Information
  – Traders have many sources of information
    • Polls, past results, analysis, etc.
Conclusion

• Under reasonable criteria, prediction markets are effective
Compare Prediction Markets to Other Types of “Crowdsourced” Knowledge
Paper 2

Introduction

• Uses internal prediction market at Google
• Examines efficiency of the market
  – Conclusion: Relatively efficient with persistent biases
• Observes demographic and location information on traders and studies the trends
  – Conclusion: location matters
Google’s Prediction Market

• Internal WTA market for Google employees only
• 1,463 employees participated (about 15% at the time) in 25-30 markets
  – Not a random sample
• Trades were about:
  – Google-related events (release dates, sales targets)
  – “Fun” markets: not Google related
• Trades took place in “Goobles,” which could convert into raffle tickets for prizes
Differences to Consider

• Public vs. Private
  – Inside information

• Real money vs. Fake money
  – Do the incentives line up?
Biases: The Efficiency of Google’s Markets

• Favorite Bias
  – Outcomes that are likely to occur are overpriced
  – Counter-intuitive: in presence of liquidity constraints, greater risk can be taken in long-shots versus favorites
  – Methodology: break all contracts into 20 bins based on price, and calculate probability for events in that bin.
Biases: The Efficiency of Google’s Markets

Figure 1. Prices and Payoff Probabilities in Google's Prediction Market

The 70,706 trades are sorted into 20 bins according to price (i.e., 0-5, 5-10, etc.) and then average price and payoff probability for the bin is plotted. The blue line is a regression equation obtained via OLS. Confidence intervals adjust for clustering of outcomes within market.
Biases: The Efficiency of Google’s Markets

• Extreme Aversion
  – Traders misjudge very small probabilities
  – Counteracts favorite bias at extremes
  – Also present in Intrade and larger markets
Biases: The Efficiency of Google’s Markets

• Short Aversion
  – Traders prefer to hold long positions versus short positions
  – Evidence: more arbitrage opportunities exist where trades sum to more than one than less than one
Biases: The Efficiency of Google’s Markets

• Optimism
  – Outcomes that are good news for Google are overpriced
  – This effect is magnified on days after the stock rises
  – Particularly true in new hires -> traders get smarter over time
  – Impact on theory of entrepreneurship
Will Mitt Romney Win the Election?
Pres12_WTA
2012 US Presidential Election Winner Takes All Market

![Price Chart](image)
Barack Obama

67.0%

Today's Change: +1.2
Shares Traded: 3,355,634

Mitt Romney

33.1%

Today's Change: -1.3
Shares Traded: 2,880,104

Obama vs. Romney - Daily Close Prices

Advanced Chart and Data Download: Barack Obama and Mitt Romney
A single trader lost between $4 and $7 million placing a flurry of bets on Republican presidential candidate Mitt Romney on Intrade in the final two weeks of last year’s election, according to a new research paper studying election betting patterns.

"Trader A," as the research paper dubs the trader, was responsible for about one-third of the money bet on Romney over the last two weeks — and about one-quarter over the entire cycle on Intrade.